

Figure 1(a) 6" x 6" setup reticle for the preferred embodiment (10 x 12 field point array)

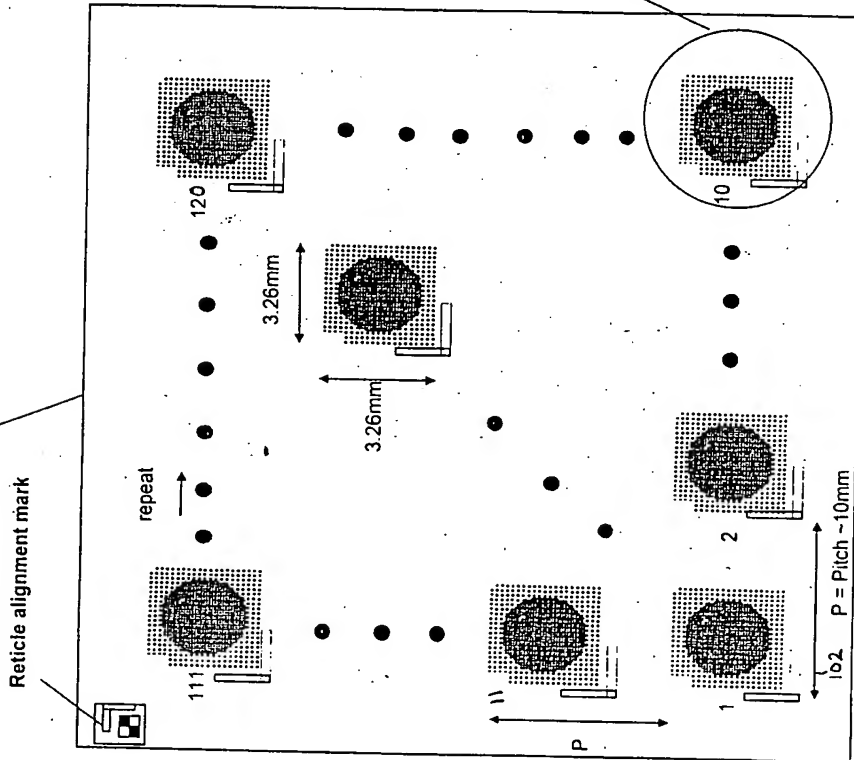


Figure 1(b) side view of preferred setup reticle plate

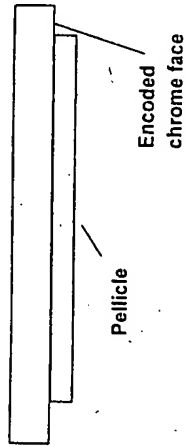
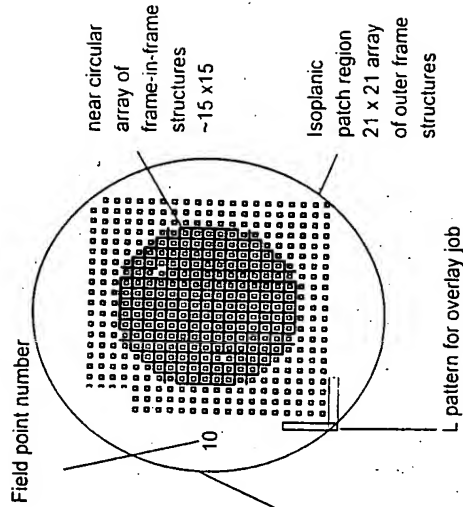


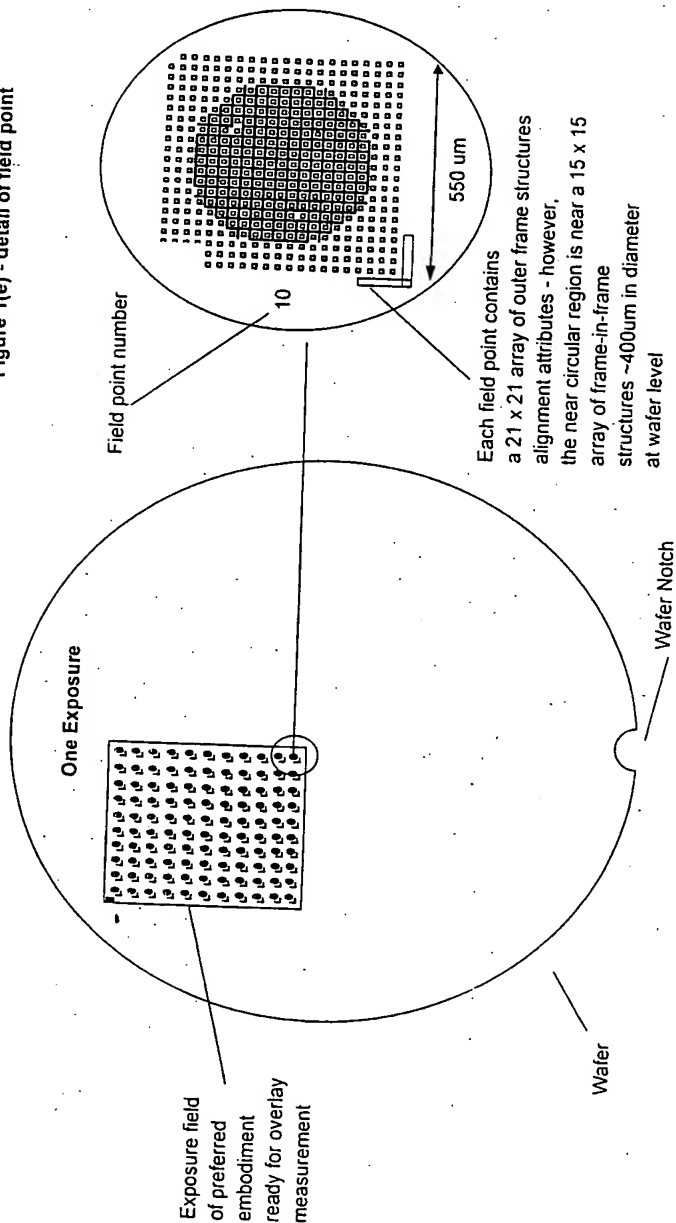
Figure 1(c) - detail of field point



mm = millimeters, μ m = microns

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Figure 1(d) Preferred embodiment - typical wafer level exposure pattern



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Figure 2(a) Prior Art Printed ISI reticle image (two exposures) from U.S. Patent 5,978,085 - one field point

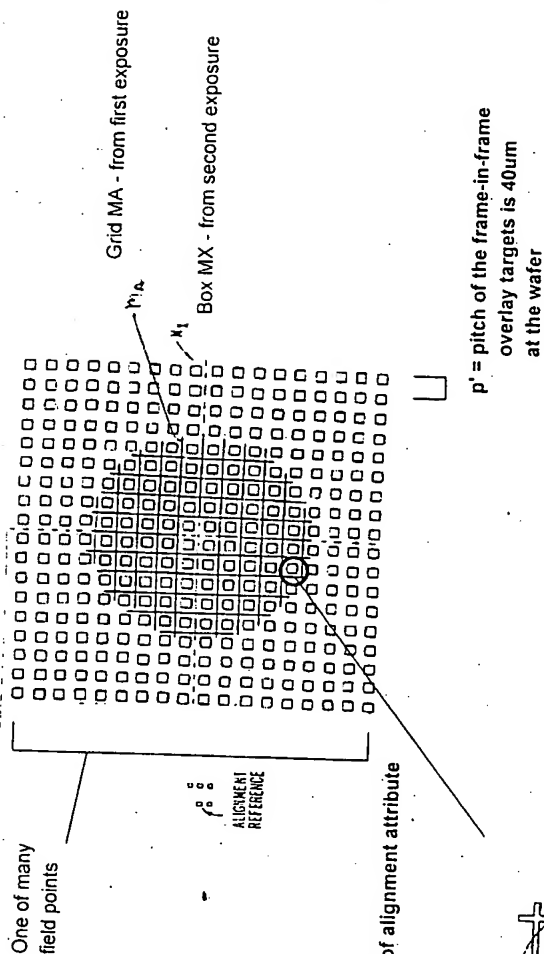
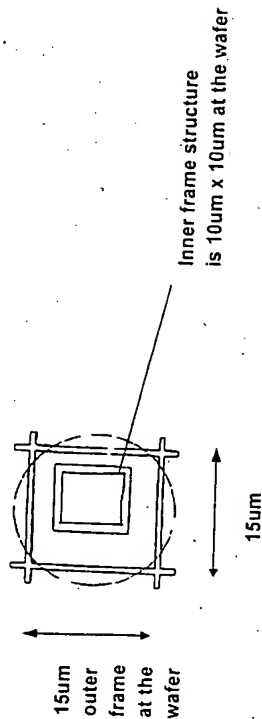


Figure 2(b) close-up view of alignment attribute



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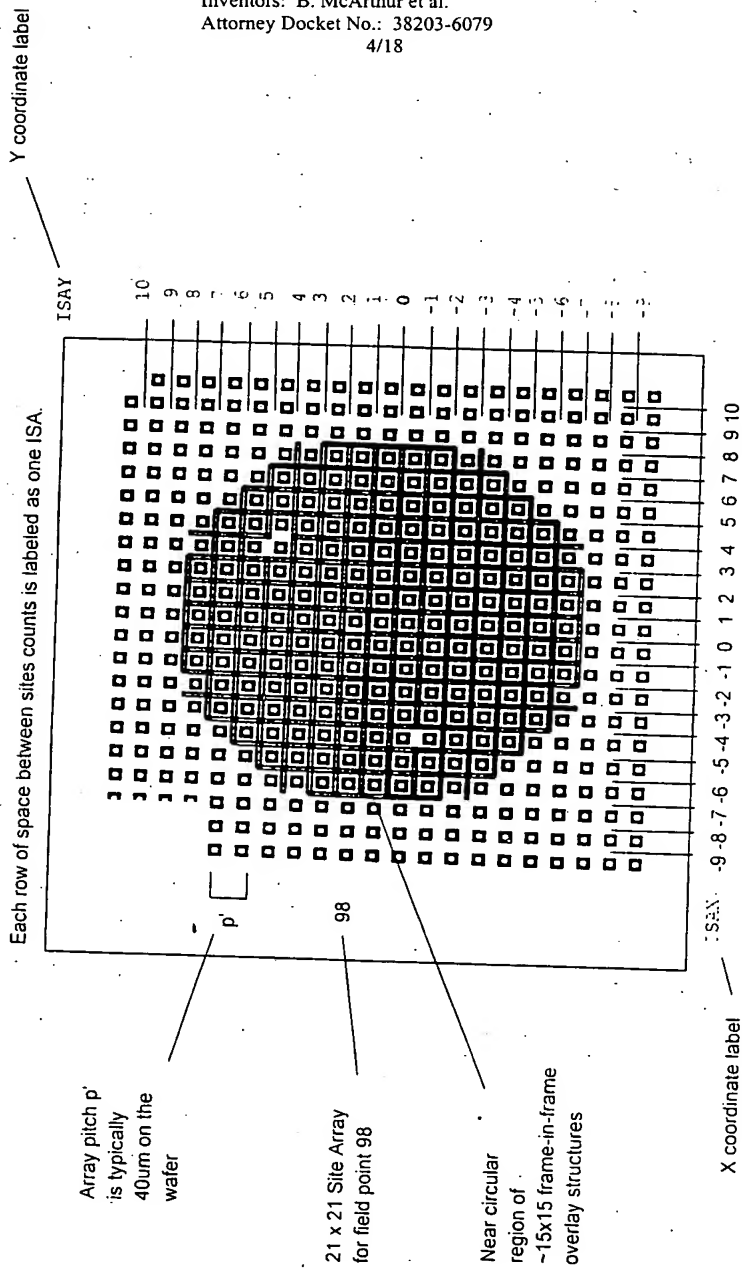


Figure 4(a) Site arrays of field points
55,56,65,66 for the preferred embodiment

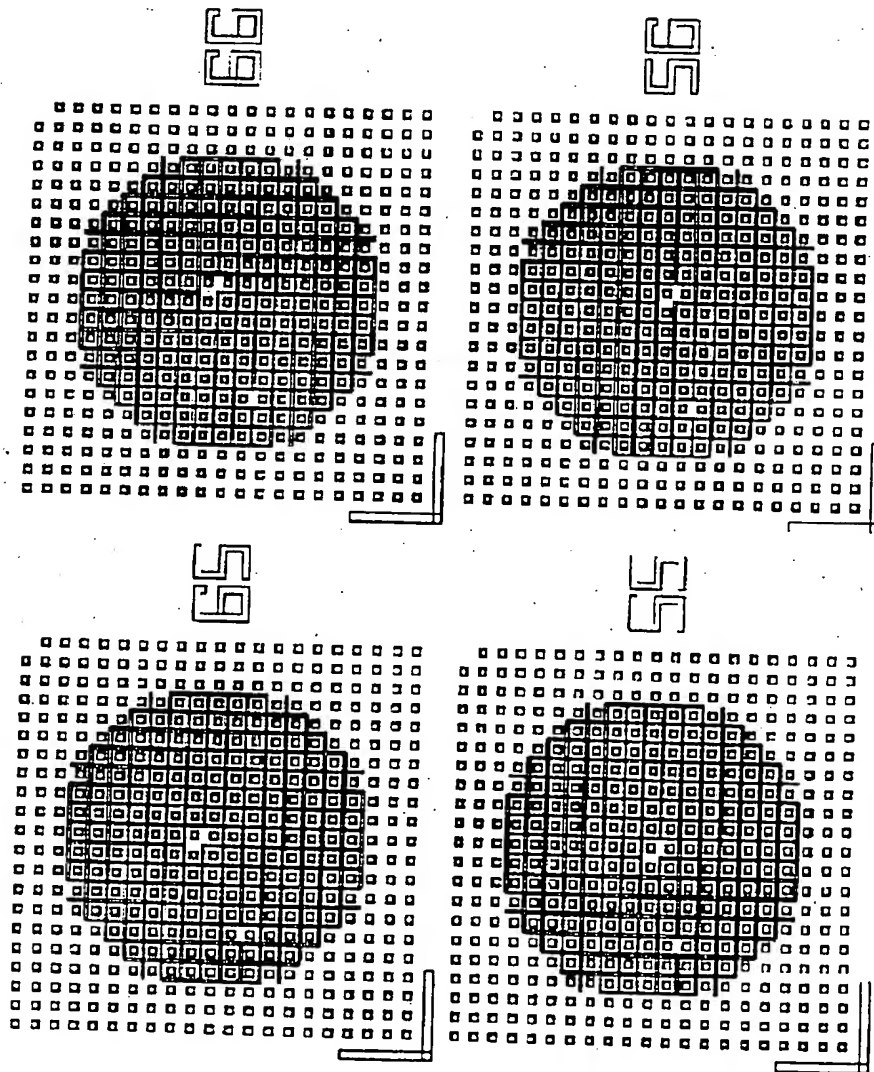


Figure 4(b) Field Point coordinate array diagram

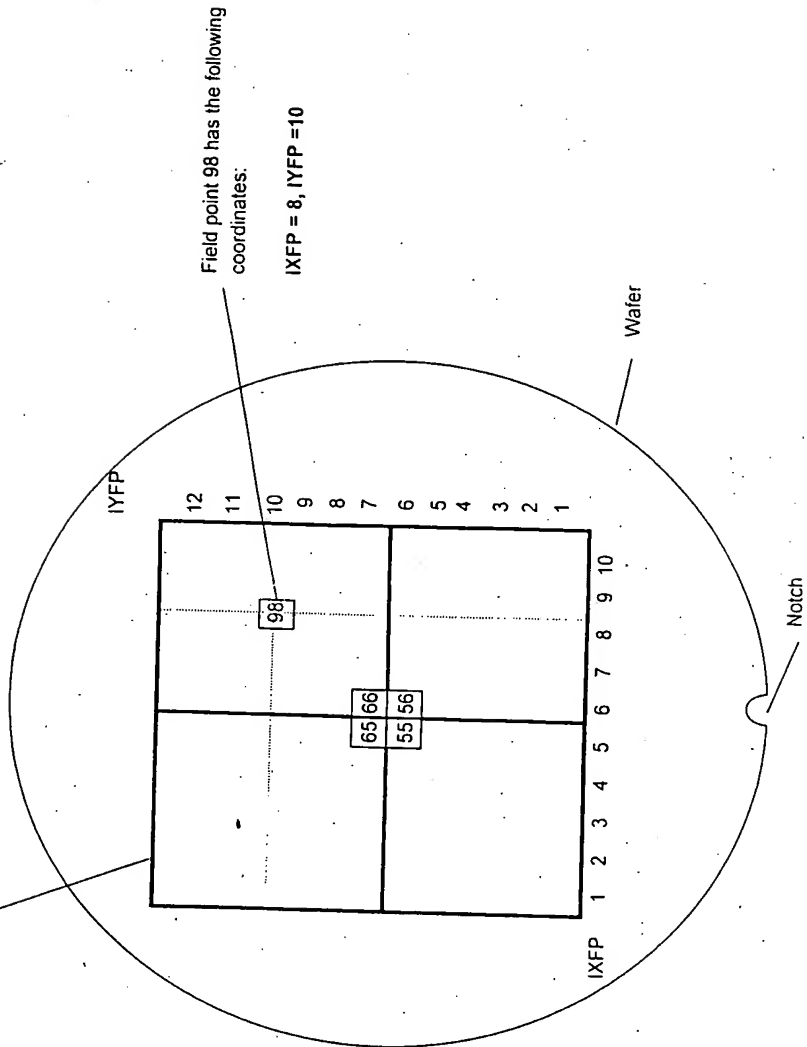


Figure 5(a) Sign convention for BBX and BBY offsets and fourth encoding scheme at wafer level
The small inner frame is shown mis-aligned to the larger outer frame this produces
an x-shift and y-shift overlay positional offset (+BBX and +BBY)

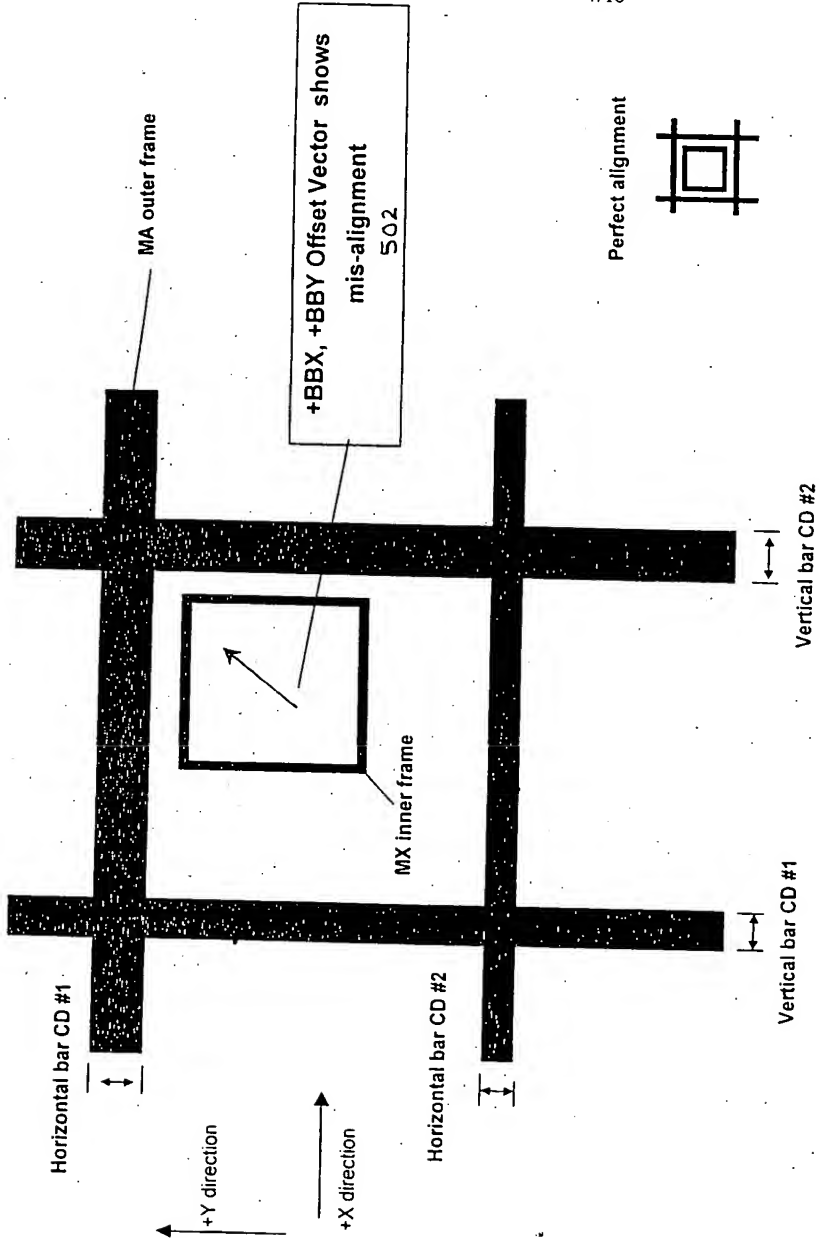
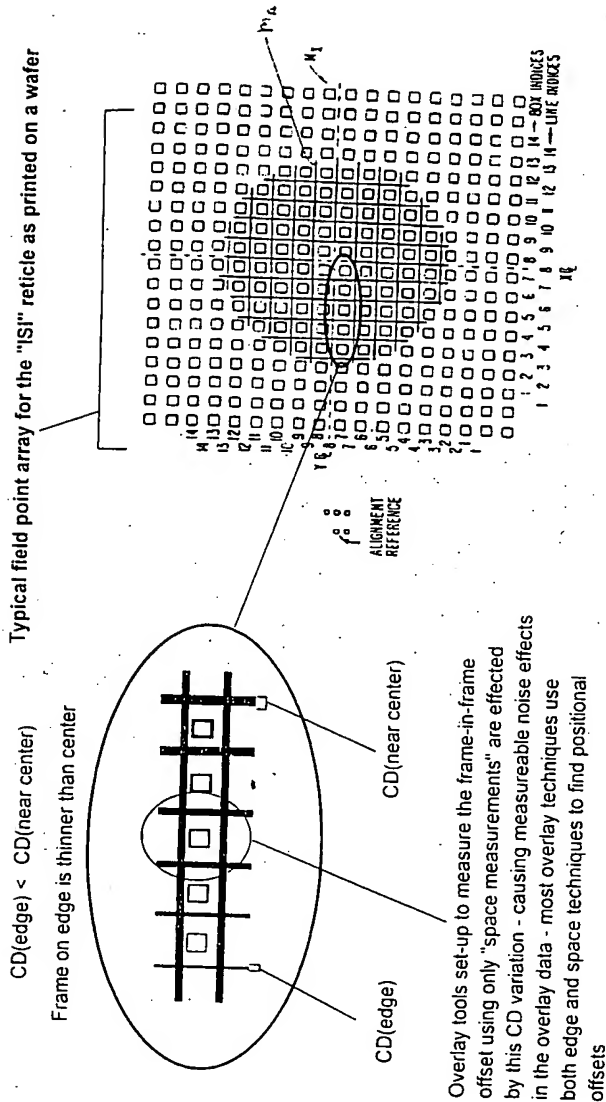


Figure 5(b) Typical Overlay errors



Overlay measurements using space techniques Overlay measurements using CD or edge techniques



Prior Art

Title: "Method and Apparatus for Proper
Ordering of Registration Data"

Inventors: B. McArthur et al.

Attorney Docket No.: 38203-6079

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Figure 5d, Bar in box or frame in box
measurement producing non zero offset in
presence of CD variation ($CDL > CDR$).

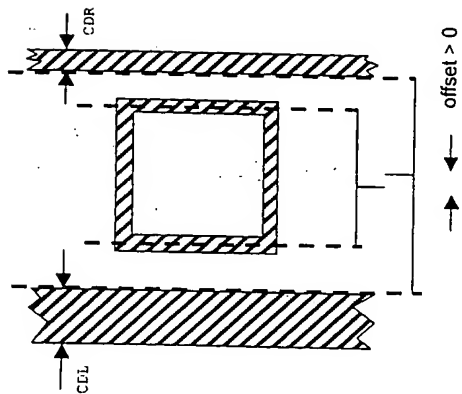
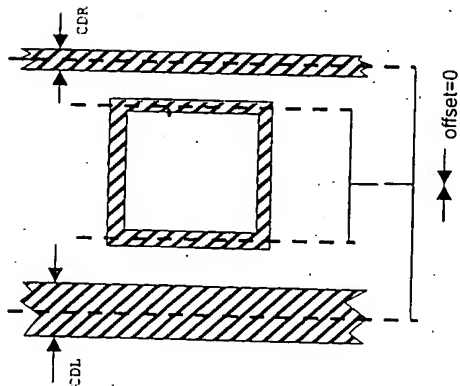


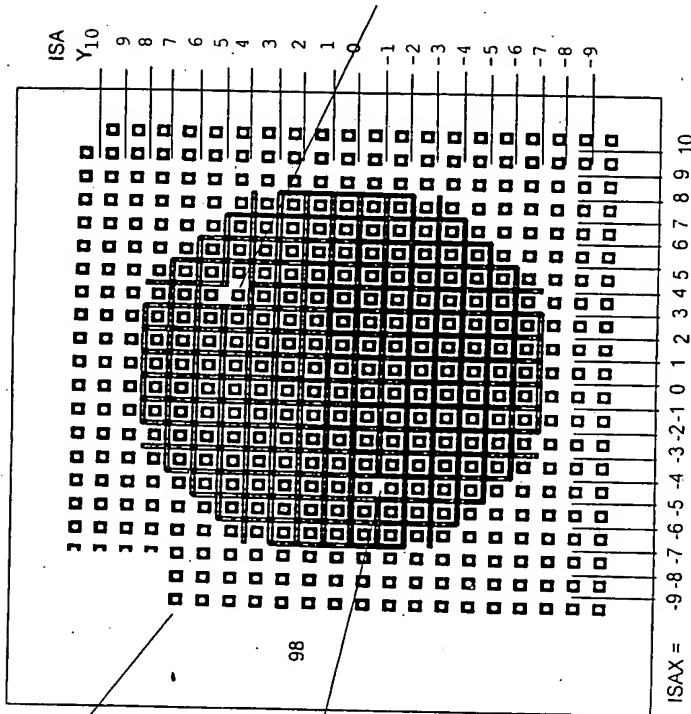
Figure 5c, Bar in bar or frame in frame
measurement producing 0 offset in presence of
CD variation ($CDL > CDR$).



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Figure 6 First two encoding schemes - missing-bar layout for field point 98

21 X 21 array of outer frame structures for this site array



First Encoding Scheme

Every field point has the exact same single missing horizontal bar taken from an outer frame structure.

For example, the lone missing horizontal bar is located at ISAY = -1 and between ISAX = -4 and ISAX = -5.

Second Encoding Scheme

Each field point has a different missing double bar pattern taken from the outer frame structures

For example,

Here the verticle missing bar is located at ISAY = 5 and between ISAX = 3 and ISAX = 4.

The horizontal missing bar is located at ISX = 4 and between ISAY = 4 and ISAY = 5

Figure 7 Example of overlay measurement offsets (BBx, BBy) at field point 98

FP = 98

DSOSQ_W = 0.0625

IX_O = 14
IV_O = 15

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		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
BBx	0.563	0.500	0.438	0.375	0.313	0.250	0.188	0.125	0.063	0.000	-0.063	-0.125	-0.188	-0.250	-0.313	-0.375	-0.438	-0.500	-0.563	-0.625	-0.688	-0.750
	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625
BBy	0.563	0.500	0.438	0.375	0.313	0.250	0.188	0.125	0.063	0.000	-0.063	-0.125	-0.188	-0.250	-0.313	-0.375	-0.438	-0.500	-0.563	-0.625	-0.688	-0.750
	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625

Figure 8 location of (0,0) point of frame-in-frame data on setup-reticle

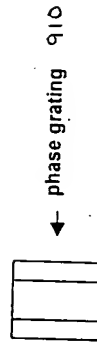
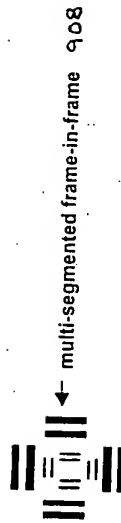
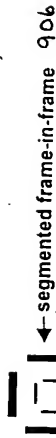
IX0 = position within 21 x 21 array where (BBx, BBy) = (0,0) occurs
IY0 = field point number
FP = field point number

IY=Row	7	8	9	10	11	12	13	14	15	16
12	17	17	17	17	17	17	17	17	17	17
	111	112	113	114	115	116	117	118	119	120
11	7	8	9	10	11	12	13	14	15	16
	16	16	16	16	16	16	16	16	16	16
	101	102	103	104	105	106	107	108	109	110
10	7	8	9	10	11	12	13	14	15	16
	15	15	15	15	15	15	15	15	15	15
	91	92	93	94	95	96	97	98	99	100
9	7	8	9	10	11	12	13	14	15	16
	14	14	14	14	14	14	14	14	14	14
	81	82	83	84	85	86	87	88	89	90
8	7	8	9	10	11	12	13	14	15	16
	13	13	13	13	13	13	13	13	13	13
	71	72	73	74	75	76	77	78	79	80
7	7	8	9	10	11	12	13	14	15	16
	12	12	12	12	12	12	12	12	12	12
	61	62	63	64	65	66	67	68	69	70
6	7	8	9	10	11	12	13	14	15	16
	11	11	11	11	11	11	11	11	11	11
	51	52	53	54	55	56	57	58	59	60
5	7	8	9	10	11	12	13	14	15	16
	10	10	10	10	10	10	10	10	10	10
	41	42	43	44	45	46	47	48	49	50
4	7	8	9	10	11	12	13	14	15	16
	9	9	9	9	9	9	9	9	9	9
	31	32	33	34	35	36	37	38	39	40
3	7	8	9	10	11	12	13	14	15	16
	8	8	8	8	8	8	8	8	8	8
	21	22	23	24	25	26	27	28	29	30
2	7	8	9	10	11	12	13	14	15	16
	7	7	7	7	7	7	7	7	7	7
	11	12	13	14	15	16	17	18	19	20
1	7	8	9	10	11	12	13	14	15	16
	6	6	6	6	6	6	6	6	6	6
	1	2	3	4	5	6	7	8	9	10

IX=Col

20030426 010402

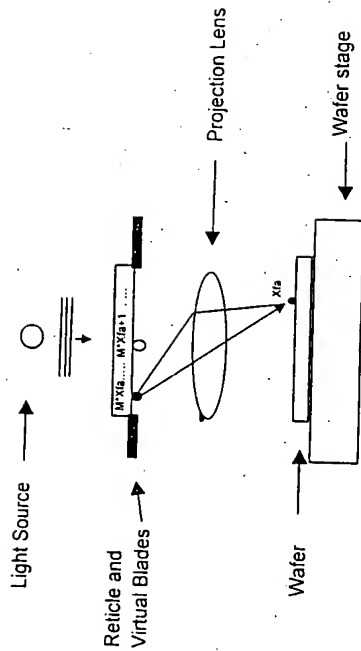
Figure 9 Typical overlay patterns
or completed alignment attributes



Prior Art

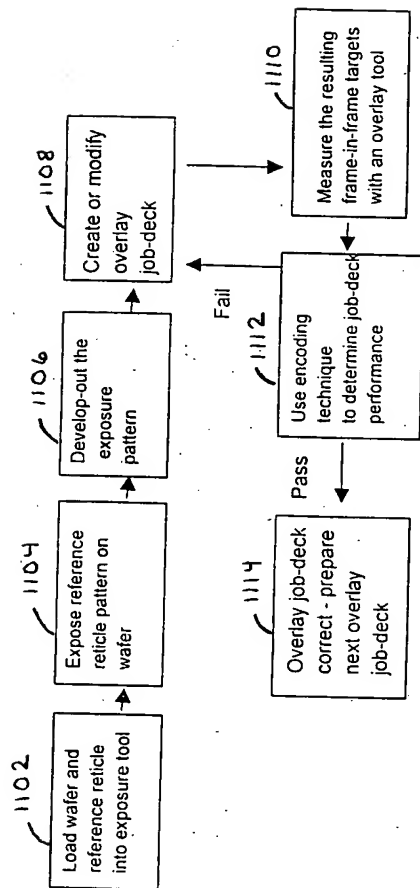
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Figure 10 Photolithographic stepper or scanner system



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Figure 11 Process flow for a method of verifying proper order of a job deck.



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Figure 12 Reticle and resist frame-in-frame description for a typical ISA coordinate site ISAX, ISAY

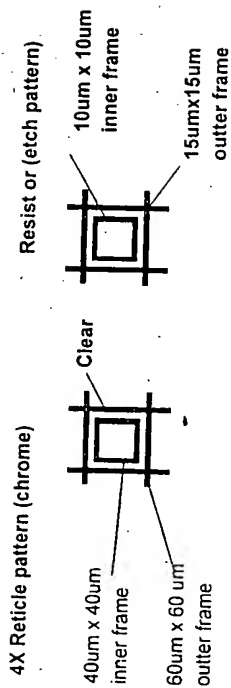


Figure 13 Centered
Frame-in-Frame structure
No shift: ISAX = 0, ISAY = 0

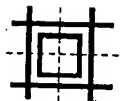
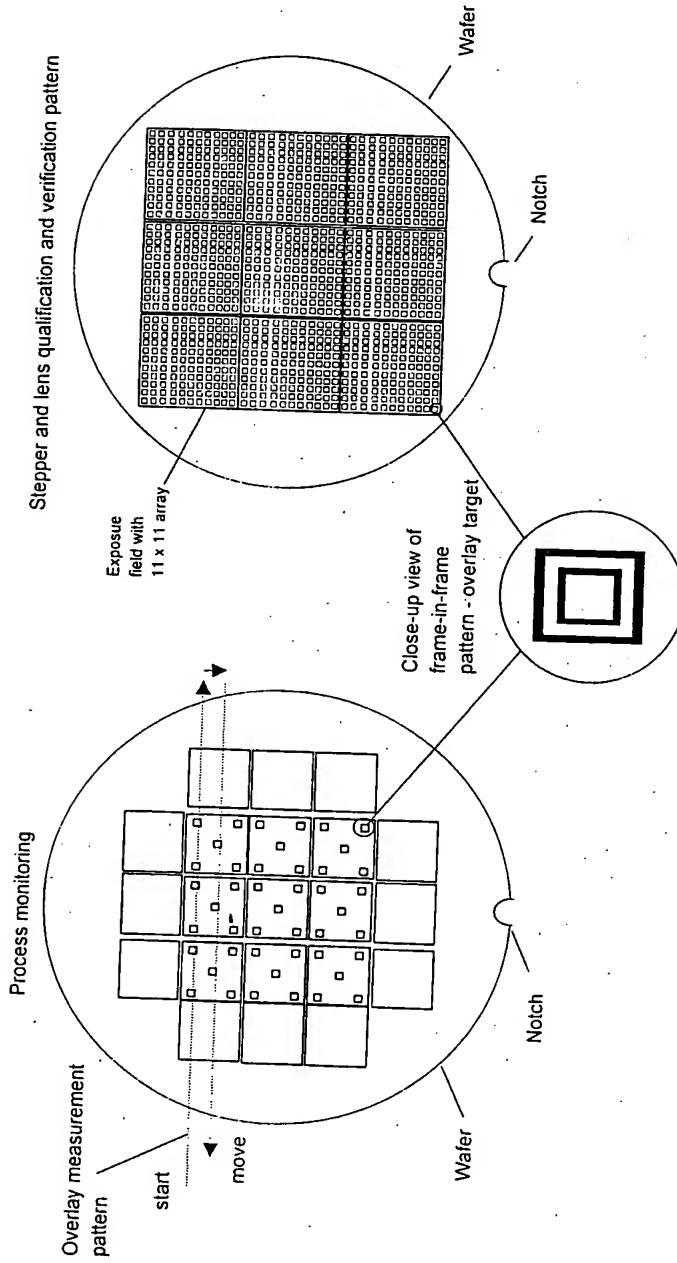


Figure 14 Prior art - exposure patterns: Process monitoring and Stepper qualification



Prior Art

Figure 15(a) Process flow for prior art - Photolithographic tool set-up

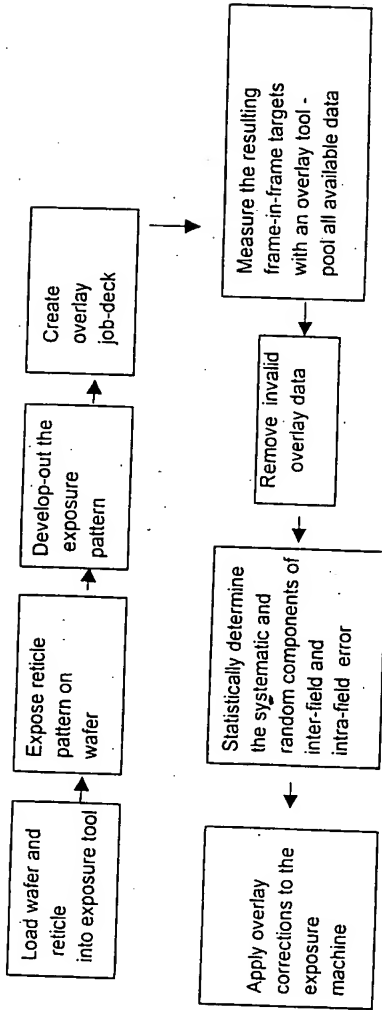


Figure 15(b) Process flow for prior art - Production use of overlay

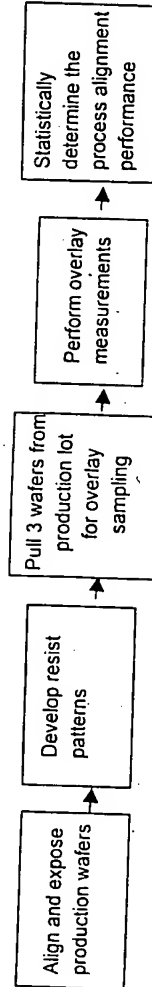


Figure 15(c) Process flow for prior art - lens aberration measurement

